

# auri research brief

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## A Study on Reasonable Policy Direction for Strengthening Building Safety

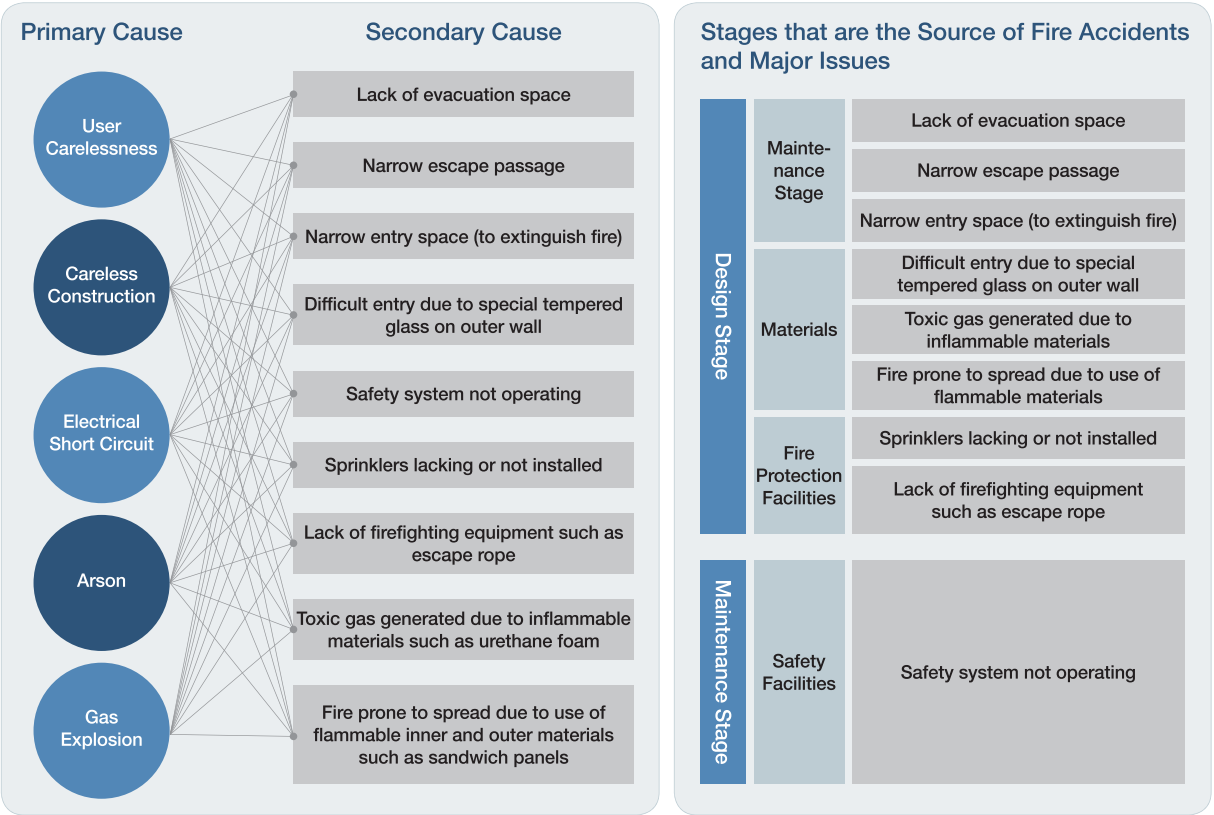
### Introduction

The purpose of this study is to provide reasonable policy alternatives in response to building safety risks. In other words, it will be vigilant against the policy response that has reinforced the relevant regulations every time a safety accident occurs, and will provide a feasible alternative based on the cause of actual safety accidents and the safety situation of domestic buildings. To accomplish this, three major tasks were performed in this study. First, the cause and risk factors of universal safety accidents were derived by grasping the current state of safety accidents and architectural safety in Korea. Second, the current status and limitations of related systems such as the trend of the current building security enhancement policy, and related laws and regulations have been reviewed. Third, implications of safety management system of foreign buildings and related system are derived. Through these tasks, the policy direction for building safety is presented.

Analysis of the status of buildings safety accidents and risk factors

According to the statistics of the National Statistical Office, the main causes of damage of building fires were rapid combustion of flammable materials, as well as delay in reporting fire, dry weather conditions and strong winds, remote fire stations, delay in arrivals due to traffic accidents or illegal parking. Large fires spread very quickly from the beginning of the fire, and 70% of deaths are caused by toxic gas inhalation of flammable materials. In the case of firefighting facilities, which cause delays in reporting the fire, major causes were fire detector failures, emergency alarm facility failures, and ineffective sprinklers. The main cause of collapse is poor management of facilities.

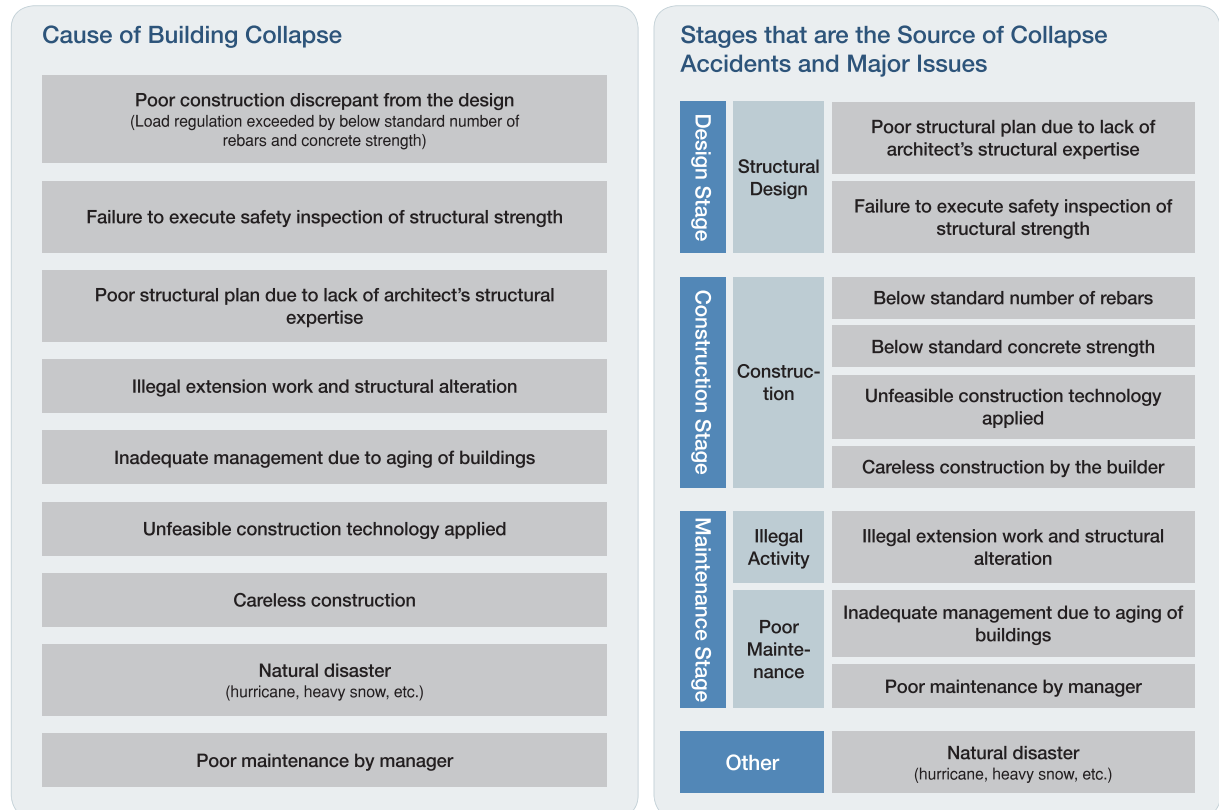
We examined the causes of 17 major fire accidents and the causes of secondary damage in Korea, which suffered major casualties from 1960s to 2014. Generally, the main causes of these accidents were electric leakage, welding fireworks, gas explosion, and arson. However, it is the structure of buildings and the appropriateness of firefighting facilities that determine the scale of damage after the fire starts. The cause of damage at the construction phase identified in the case of accidents is non-compliance with design criteria for safety facilities at the design stage for evacuation passages, entryways, etc.



Building Fire Related Issues

The causes of accidents can be divided into carelessness of the contractor in the construction phase and neglect of management in the maintenance stage. During the construction phase, problems that may occur are short-circuits due to carelessness of the constructor during construction, gas explosion and poor construction that do not meet the design standards. Finally, the causes of accidents in the maintenance stage include a failure of the safety system due to management oversight, failure to secure an evacuation route, and uncertain distance between adjacent buildings. In addition, due to low efficiency in the finishing material performance used in illegal alterations of internal space, the damage caused by excessive toxic gas generation is bigger.

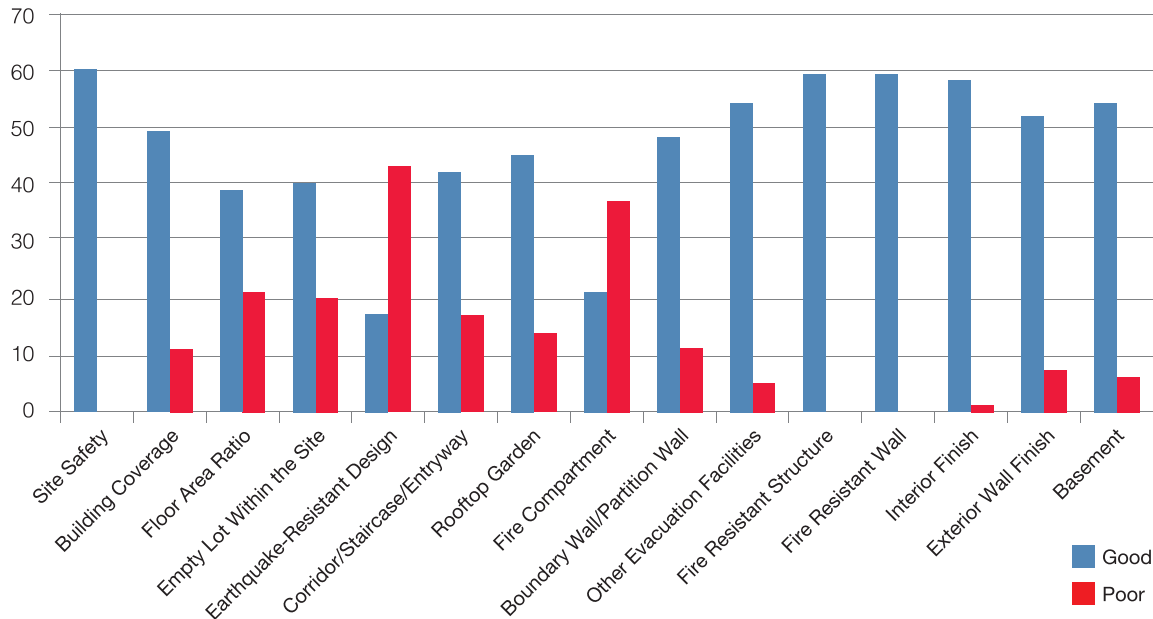
In the case of collapse accidents, there are problems such as failure of structural design due to insufficient structural expertise of the architect and failure of structural safety diagnosis. The causes of safety accidents related to the construction phase include poor construction of reinforced concrete placement and concrete cladding, poor foundation work, application of unreasonable construction techniques for cost reduction, and carelessness of contractors during construction. The reason for the safety accidents in the maintenance stage is due to illegal construction of the building or structure alteration after the completion of the building, as well as poor maintenance and management of the building.



Problems related to Collapse of Buildings, by Phase

As confirmed by statistical surveys and case studies, fire and collapse accidents are caused by insufficient maintenance in the process of using existing buildings. Therefore, we conducted a survey on buildings managed through the current building maintenance and inspection system. As a result, we found two major results. First, regarding the state of the building, the safety management status of small-scale, structure A (masonry, concrete, wooden, other structure) buildings that are 20 years or older, is the worst and should be considered as priority when implementing a safety enhancement policy.

Second, the facilities for preventing fire and collapse of buildings such as the safety of the site include structural strength (seismic design), corridors, stairs, doors, fire doors, open rooftops and interior and exterior finishing materials. Safety risk factors are empty lots in a reduced site, distance from adjacent buildings, lack of earthquake-resistant design, narrow evacuation passages and stairways, illegally modified stairways, locked doors on evacuation floors, demolished or deformed fire doors, flammable inner partitions and interior/exterior finishing materials, impractical underground evacuation staircases and evacuation routes. These risk factors virtually coincide with the cause of accidents based on the above-described safety accident statistics and case analysis.



Analysis of Research Results on the Actual Condition of Building Safety Management

## The current status and problems of safety policies and legal system

The Building Security Enhancement Policy is implemented mainly by the Ministry of Land, Infrastructure and Transport and the Ministry of Public Safety and Security. This policy focuses on enhancing the physical structure of the buildings, that is, the inner and outer spaces and forms of buildings, and the surrounding environment.

### Status of the Building Safety Policy of the Ministry of Land, Infrastructure and Transport

Policy	Main Content	Year
Promote earthquake prevention measures for main facilities	<ul style="list-style-type: none"> <li>• Apply earthquake-resistant design</li> <li>• Create and submit confirmation document of earthquake-resistant design</li> <li>• Implement earthquake-proof evaluation and promote earthquake-resistant reinforcement according to management authority</li> </ul>	2010
Comprehensive measures to improve safety management of high-rise buildings	<ul style="list-style-type: none"> <li>• Prepare management plans for high-rise buildings</li> <li>• Fire safety measures</li> <li>• Introduce pre-evaluation system for fire prevention / response plan, and prepare and distribute safety management standard manuals</li> </ul>	2010
Promote enhancement of fire safety in warehouses, factory buildings	<ul style="list-style-type: none"> <li>• Expanded use of flame retardant finish materials</li> <li>• Buildings that use flame retardant finish material</li> <li>• Add rooftop</li> </ul>	2013
Countermeasures for the safety management of buildings against climate change	<ul style="list-style-type: none"> <li>• Adjustment of building structure standards against unusual weather</li> <li>• Strengthen internal stability of the design and supervision of special structures such as PEB(pre-engineered building)</li> <li>• Enhanced management of illegal use change</li> </ul>	2014
Comprehensive measures to strengthen building safety	<ul style="list-style-type: none"> <li>• Expand range of persons that is subject to punishment for violating building law, and increase fines</li> <li>• Introduce "Safety impact assessment" system</li> <li>• Carry out "Construction safety monitoring"</li> <li>• Apply usage criteria of flame retardant materials, structural safety standards, etc. to wider area</li> <li>• Establish manufacturing and distribution management system of building materials</li> <li>• Designate a building maintenance manager and report it to the competent authority</li> </ul>	2014
Improvement of building safety system to be felt by public	<ul style="list-style-type: none"> <li>• Revision of safety-related laws</li> <li>• Revision of ventilation installation regulations, distribution of design, construction and maintenance guidelines to local governments</li> <li>• Spread usage of flame retardant exterior wall finishing materials</li> </ul>	2015
Introduction of real name system in building supervisors, construction type, stage	<ul style="list-style-type: none"> <li>• Strengthen responsibilities of supervision</li> </ul>	2015

The Ministry of Public Safety and Security aims to provide support in the prevention of disasters such as fire or collapse after the building is constructed; and seek to systematically and autonomously manage experts and the public for post counter-measures. The result of these policies can be anticipated in three aspects.

#### Safety Enhancement Policy of the National Security Agency

Policy	Main Content	Year
Establishment of Special Act on Disaster Management of High-rise and Underground Complex Buildings	<ul style="list-style-type: none"> <li>• Safety management of buildings is managed by individual laws, resulting in a safety blind spot in accordance with gaps between individual laws</li> <li>• Establishment of measures to prevent, prepare for, and respond to disasters in order to manage disasters in high-rise and underground complex buildings and their surrounding areas</li> </ul>	2011
Regular inspections of safety facilities for multi-use owners	<ul style="list-style-type: none"> <li>• Stipulates that the owner of multi-use facilities regularly inspects the safety facilities. for the safety management of the multi-use business, and the inspection results should be kept for one year</li> <li>• Adds that when operating in conjunction with other facilities and equipment of the building, the persons who manage the related facilities and equipment, such as owners and occupants of the building, should cooperate with the safety inspection of the multi-use owner</li> </ul>	2011
Seismic reinforcement support of private buildings	<ul style="list-style-type: none"> <li>• Seismic retrofitting has been institutionalized for existing public buildings not subject to seismic design, but seismic measures are not provided for civil-owned buildings</li> <li>• In order to encourage seismic retrofitting of existing private buildings not subject to seismic design, the heads of local governments state that tax exemption and insurance related organizations and institutions should apply the earthquake disaster insurance rate differently</li> </ul>	2011
Fire-fighting facilities installed in houses	<ul style="list-style-type: none"> <li>• Surface of imperfections in the current system regarding installation of fire protection facilities for fire prevention and housing</li> <li>• Indicates mandatory installation of fire extinguishing equipment and single alarm type detectors in fire-fighting facilities of houses and apartment buildings</li> </ul>	2011
Obligation to buy fire compensation and liability insurance	<ul style="list-style-type: none"> <li>• In the case of fire damage compensation and insurance, multi-use facilities of a certain size or larger are classified as special buildings, and fire insurance is obligatory. However, many fires happen in small businesses that have relatively weak safety management</li> <li>• Indicates that small businesses that are vulnerable to fire should be covered by liability insurance that is responsible for paying the amount prescribed by the Presidential Decree if the fire in a multi-use business causes death, personal injury or property damage to another facility</li> </ul>	2012



Policy	Main Content	Year
Establishment of the Ministry of Public Safety and Security Government Organization Act 22 Article 2	<ul style="list-style-type: none"> <li>• Incompetence of the department managing disaster safety for national disasters, and lack of expertise in disaster management by public officials</li> <li>• Establishes and manages policies on safety and disaster through the Ministry of Public Safety and Security. Controls tasks such as management, adjustment and emergency preparation</li> </ul>	2014
Building manager's responsibility for snow removal	<ul style="list-style-type: none"> <li>• The scope of snow removal is limited to walkways, back roads and pedestrian access roads</li> <li>• Revises the regulation to expand the scope of responsibility for snow removal for buildings by adding rooftops of facilities</li> </ul>	2014
Preparation and management of crisis manual for multi-use facilities (including training)	<ul style="list-style-type: none"> <li>• Strengthens the disaster and safety management system and improves and supplements points missing in the operation of the current regulations</li> <li>• Clarifies that the owner or manager of multi-use facilities should prepare and manage a manual to be ready against a crisis</li> </ul>	2014
Establishment and enforcement of the basic plan for fire safety	<ul style="list-style-type: none"> <li>• Fire safety management was not systematic and consistent because various matters related to fire safety were scattered throughout various laws</li> <li>• Establishes the responsibility of national and local governments for fire safety, and clarifies that the National Emergency Management Agency must establish and enforce the basic plan for fire safety policy and implementation</li> </ul>	2015
Specific buildings that require a fire safety management assistant	<ul style="list-style-type: none"> <li>• A blind spot occurs in the supervision and system of fire safety management buildings for fire prevention</li> <li>• Clarifies that specific buildings, which require a fire safety management assistant must have a fire safety manager in accordance with the standards</li> </ul>	2015
Expansion of the scope of application of strengthened fire facilities standards	<ul style="list-style-type: none"> <li>• The existing laws were limited to installing simple sprinklers and automatic fire detection systems in facilities for children and the elderly</li> <li>• In addition to facilities for children and the elderly, sprinkler facilities, simple sprinkler facilities, automatic fire detection equipment and automatic fire alarm facilities have been added to be installed in medical facilities</li> </ul>	2015
Obligation to subscribe to fire compensation liability insurance	<ul style="list-style-type: none"> <li>• There was no difference in insurance premium rate applied to multi-use facilities when entering a fire compensation liability contract with an insurance company</li> <li>• When a fire compensation liability insurance contract is concluded with an insurance company, the premium rate can be applied differently considering safety management such as safety facilities of multi-use businesses</li> </ul>	2016
Designation of the fire caution district	<ul style="list-style-type: none"> <li>• In the existing law, the fire caution district is designated as a "dense building area" of the city, but lacks the clarity on the designated area</li> <li>• After the amendment, the area is specified as a "market area and an area where warehouses and factories are concentrated"</li> </ul>	2016

※ Source: data that the researcher analyzed

First, we expanded the scope of physical management targets from existing multi-use facilities and large-scale facilities to institutional blind spots including small-scale buildings. This provided the basis for securing the safety of buildings. Second, the subjects of safety management were divided into stages of construction (design, construction and maintenance), and the roles of specialists, support agencies and users are regulated. Third, the government was able to provide room for prevention and response to sudden impacts on the industrial economy by implementing flexible policies to cope with social change and building conditions.

However, despite these policy achievements, it is not possible to obtain information on the safety status of buildings and there is no correlation analysis between safety issues and countermeasures by sector (architecture, structure, fire, construction, maintenance). Consequently, there is still a limit to the extent to which existing policy application implementations and methods are valid.

Major laws and regulations related to fire safety are divided into fire safety management and law, construction, electricity and gas. The laws and regulations related to building structure safety can be classified into laws that provide building structure standards and laws related to building structure safety management. We examined them and deducted problems by the stages of building construction.

First, since regulations on the use of flammable materials in relation to fire safety are scattered throughout the Building Law and the Fire Service Act, there is little consistency when the law is adopted. Regarding fire fighting facility installation plans, there are no regulations on sprinkler installation or installation of evacuation equipment for buildings below a certain size.

The problem with the Building Structure Safety Regulations is that it is difficult to guarantee the safety of a building's structural strength because there is no separate provision for the submission of confirmation documents in the declaration of construction, or obligatory regulations for securing structural expertise in the design of buildings of a certain size or smaller. In the construction phase, there is a penalty clause for cases where the constructor does not proceed according to the structural design drawing, and there is no separate regulation when applying technologies for special facilities, which may lead to the problem of the poor construction. In the maintenance stage, when a building user illegally extends or changes the structure, it imposes a compulsory performance deposit. However, it is difficult to grasp such situation unless reported.



### Rational policy direction for strengthening building safety

In this study, three rational policy directions were suggested, which are ‘Standardization of Building Safety and Establishment of Basic Information’, ‘Improvement of Safety Related Legal System and Upgrade of Standards’, and ‘Making the Safety Management System Flexible Through Role Diversification’. These results were derived from statistical data and case analysis of building safety accidents, actual conditions of building safety management, and research and analysis of safety management policies and the legal system. From this perspective, a ‘rational policy presented in this study is defined as a sustainable policy through clear recognition of the problem in question and diagnosis of the cause.

Policy Issues	Comprehensive Identification of Building Safety Status	Improving Systems for Systematic Management	Strengthening Roles of Responsibilities by Building Stages
	Comprehensive causes of building safety accidents	Separation of legal system and enhancement of executive ability	Final management of design and construction
	Evaluate danger level of building	Limited maintenance system	Safety training for users



Policy Direction	Policy Objective	Action Plan
	1. Standardization of Building Safety and Establishment of Basic Information	Provide building safety index and safety grade model
		Build and share building safety information system
	2. Improvement of Safety Related Legal System and Upgrade of Standards	Improve safety-related legal system on building laws
		Enhance building safety standards and improve reliability
	3. Making the Safety Management System Flexible Through Role Diversification	Strengthen the roles of experts and administrative bodies in design and construction phases
		Extension of user's management responsibilities in maintenance stage

Policy Issues and Direction related to Building Safety

First, ‘Standardization of Building Safety and Establishment of Basic Information’ is the basis for establishing mid- and long-term systematic building safety policies. As a detailed implementation task, ‘building safety index and safety grade model’ and ‘building safety information system’ were suggested. Second, ‘Improvement of Safety Related Legal System and Upgrade of Standards’ can be explained as stable and continuous management of building safety and safety of users at the construction site. The detailed tasks proposed for this were ‘improvement of safety related legal system centering on building law’ and ‘improvement of building safety standards and reliability’. Lastly, ‘Making the Safety Management System Flexible through Role Diversification’ was suggested. This is to reinforce the ‘role of the person concerned’, which is a direct cause of building safety accidents. The detailed tasks for this are ‘strengthening the roles of experts and administrative bodies in the design and construction phase’, ‘strengthening the management responsibilities of users in the maintenance and management phase’, and ‘building an autonomous safety management system in the construction market’.

**Key words :** Fire Accident, Collapse, Safty Risk Factors, Safety Management Status, Safety Enhancement Policy

